Comparison of Disdrometer and Rain Gaug[e] Measurements during pre-CHUVA*
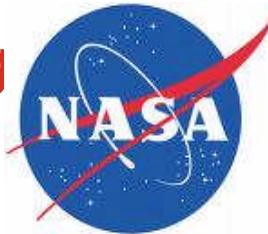
Ali Tokay[1,2], Paul G. Bashor[3,4], David B. Wolff[5,2], Walter A. Petersen[6], and Matthew Schwaller[2]

[1]JCET - University of Maryland Baltimore County
[2]NASA Goddard Space Flight Center
[3]Computer Sciences Cooperation
[4]NASA Wallops Flight Facility
[5]Science Systems Applications Inc.
[6]NASA Marshall Space Flight Center

*Cloud processes of tHe main precipitation systems in Brazil: A contribUtion to cloud resolVing modeling and to the globAl precipitation measurement

Field Campaign period: March 1-26, 2010

# Pre-CHUVA Data Acquisition Network
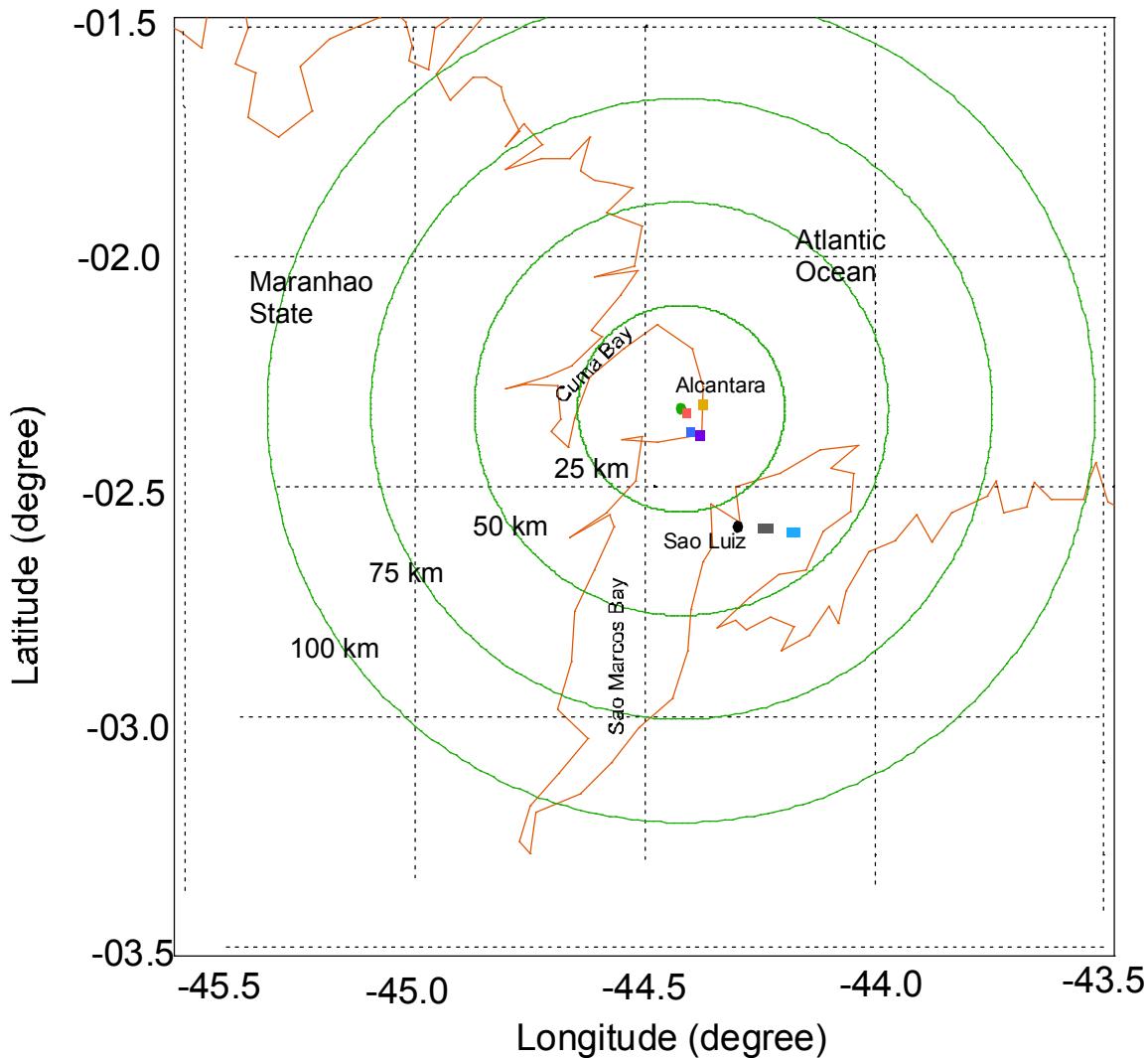
pre-CHUVA Disdrometer & Rain Gauge Sites
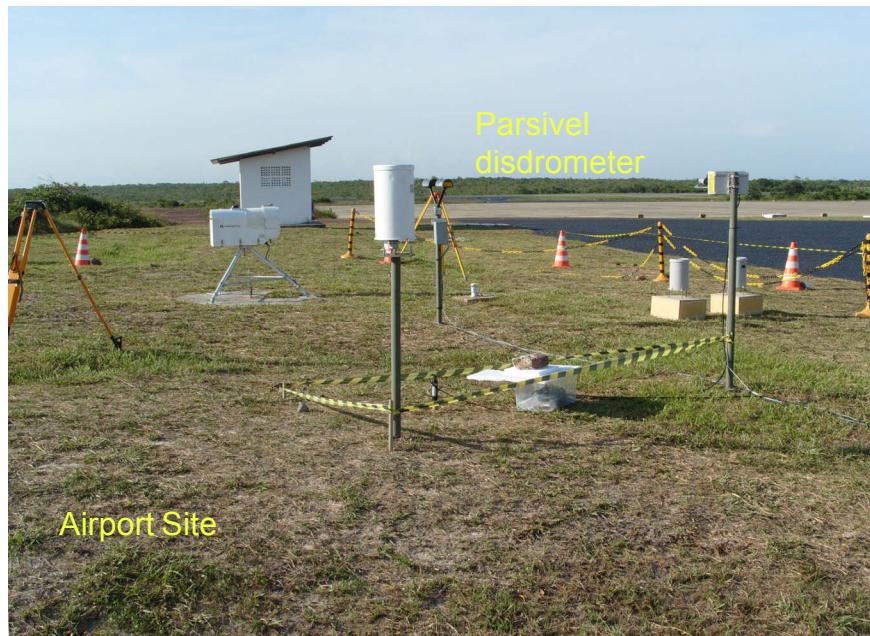
Airport Site
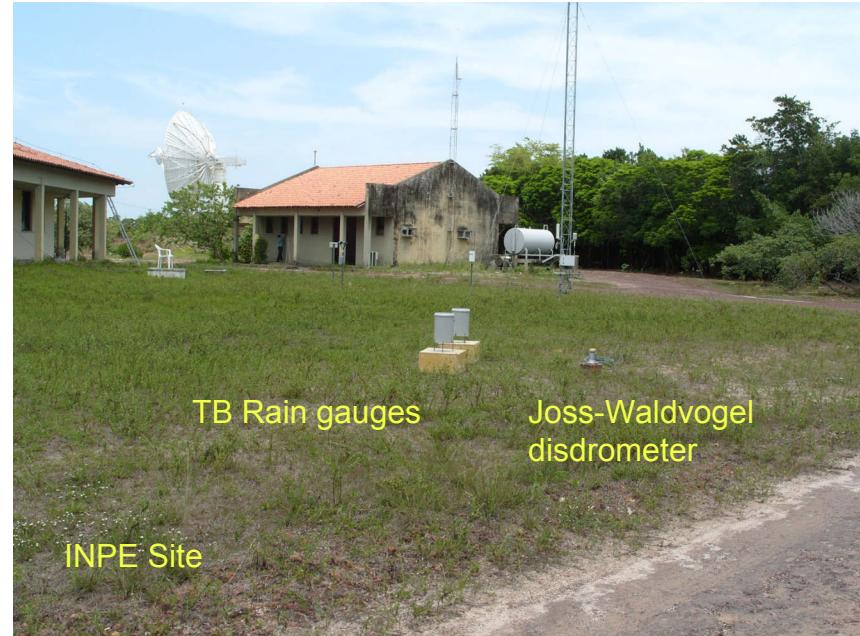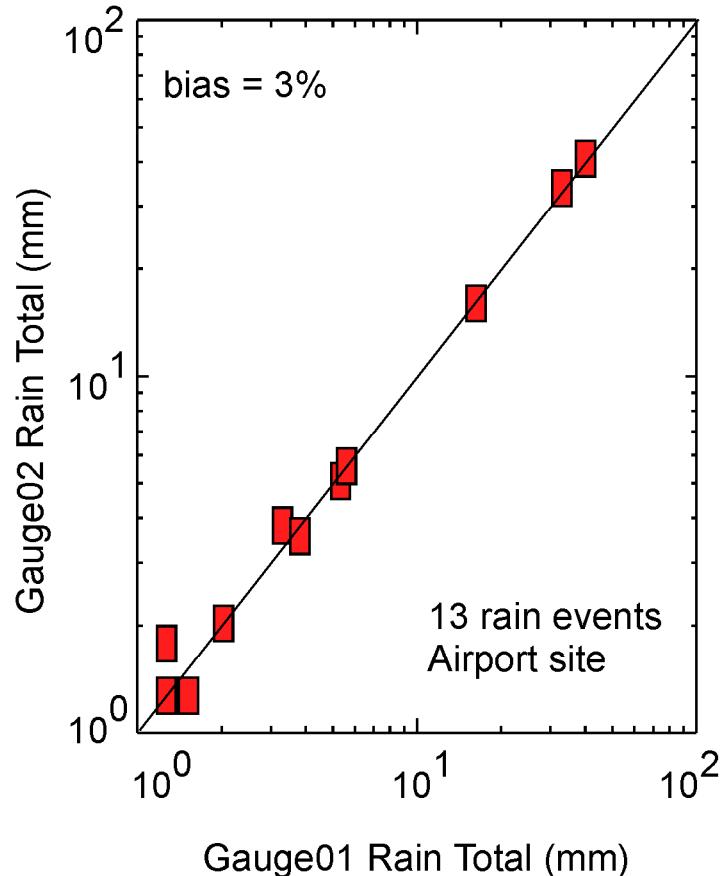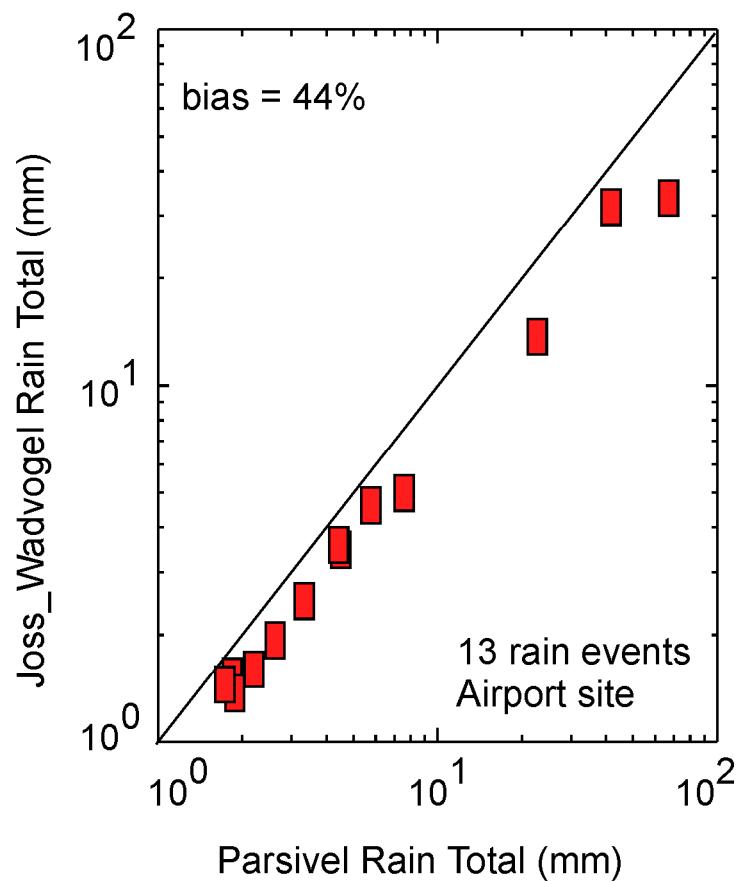
Parsivel disdrometer

INPE Site

TB Rain gauges

Joss-Waldvogel disdrometer

# Comparison of Rain Accumulation

Comparison of Rain Accumulation
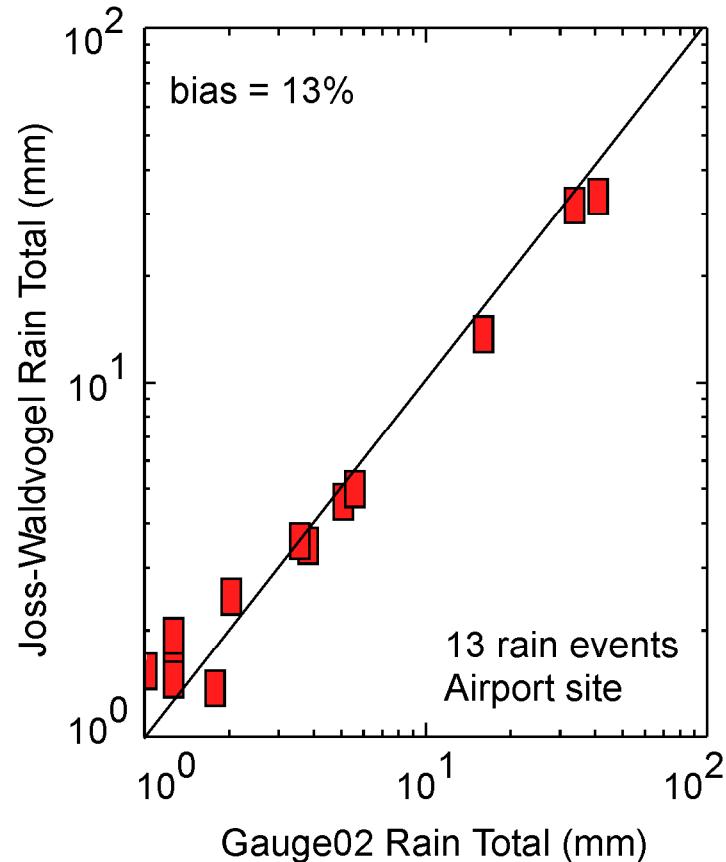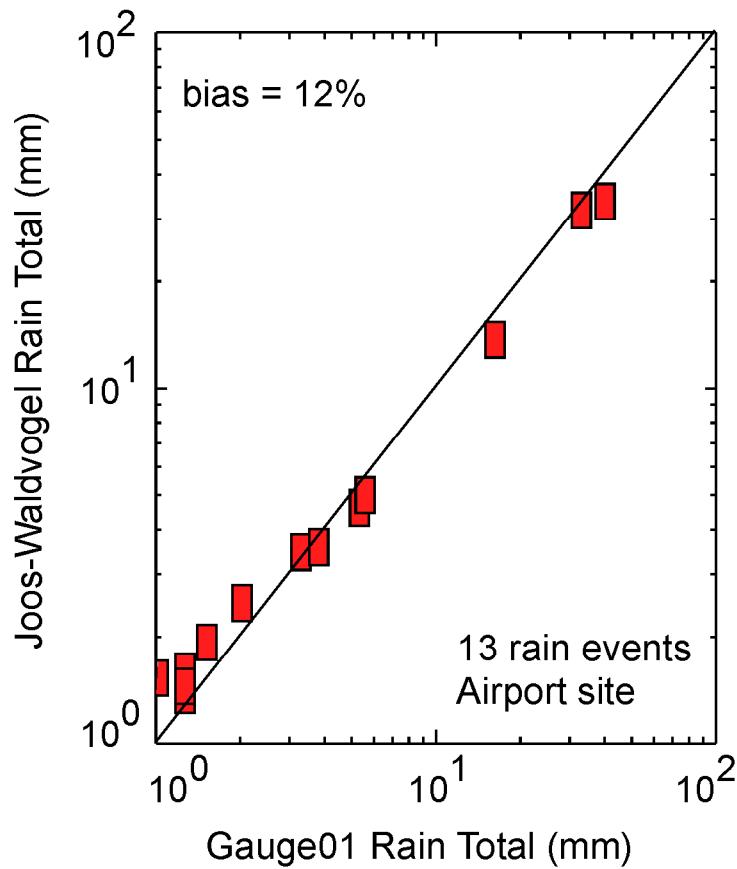
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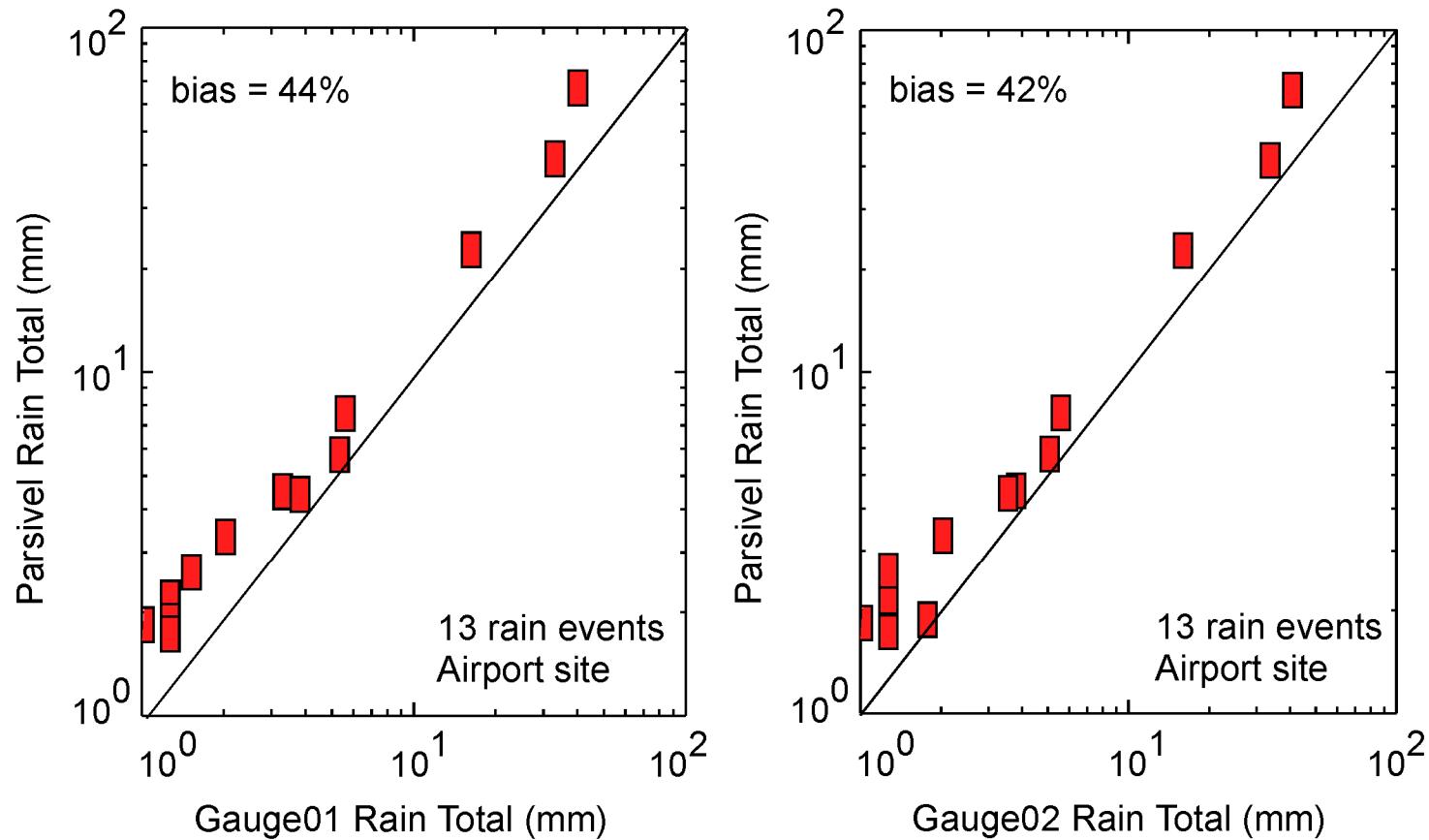
Comparison of Raindrop Size Distribution (event)
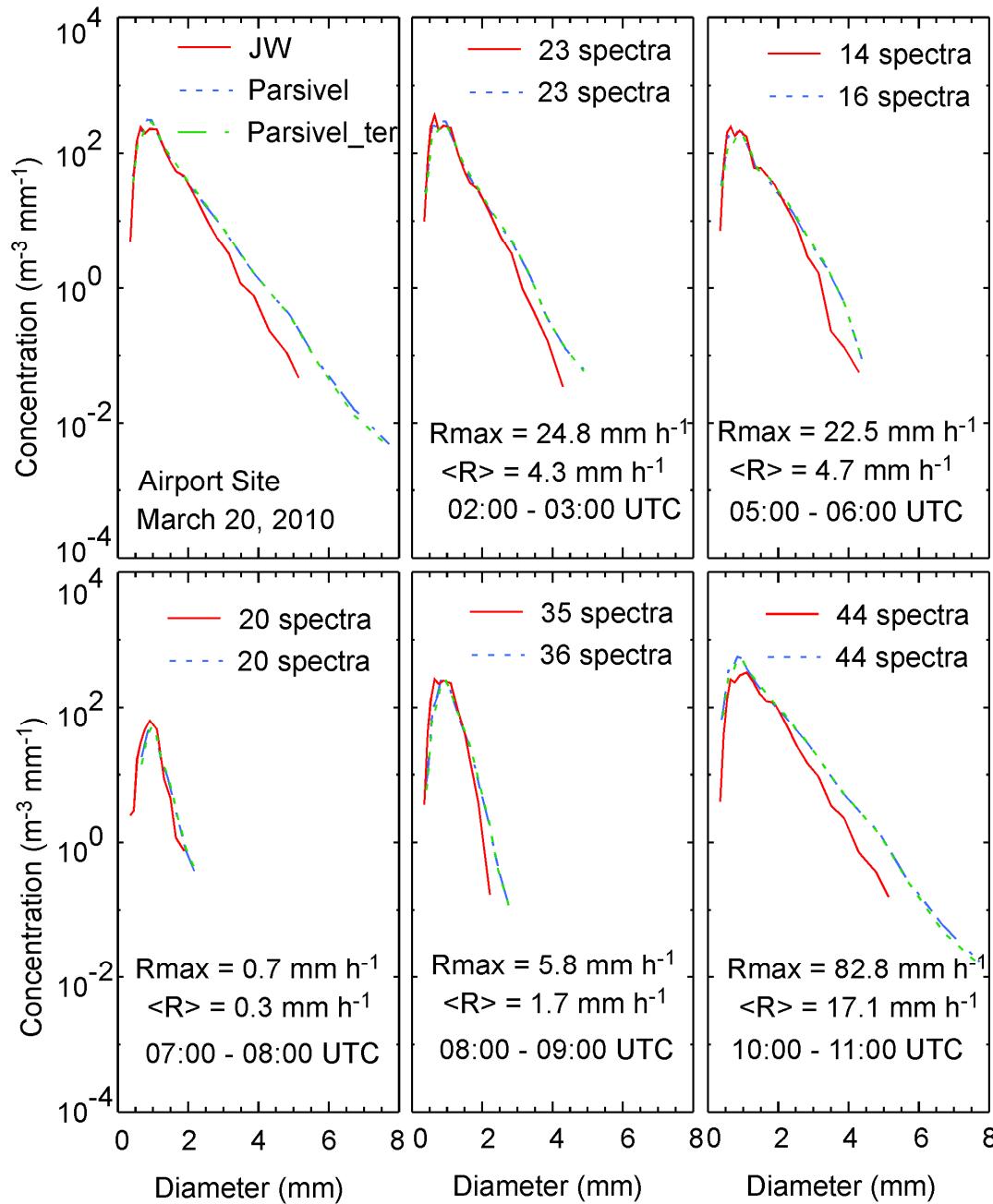
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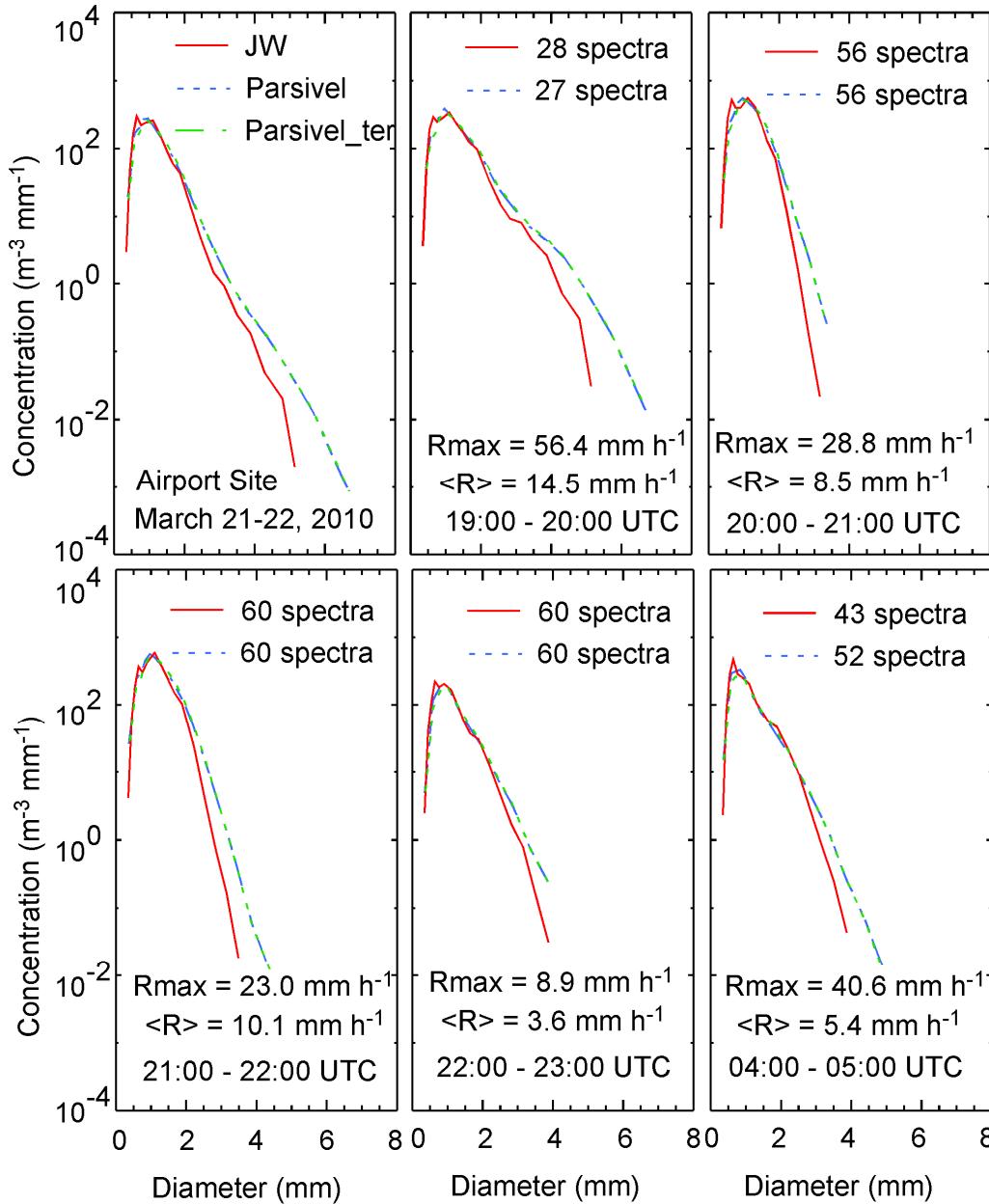
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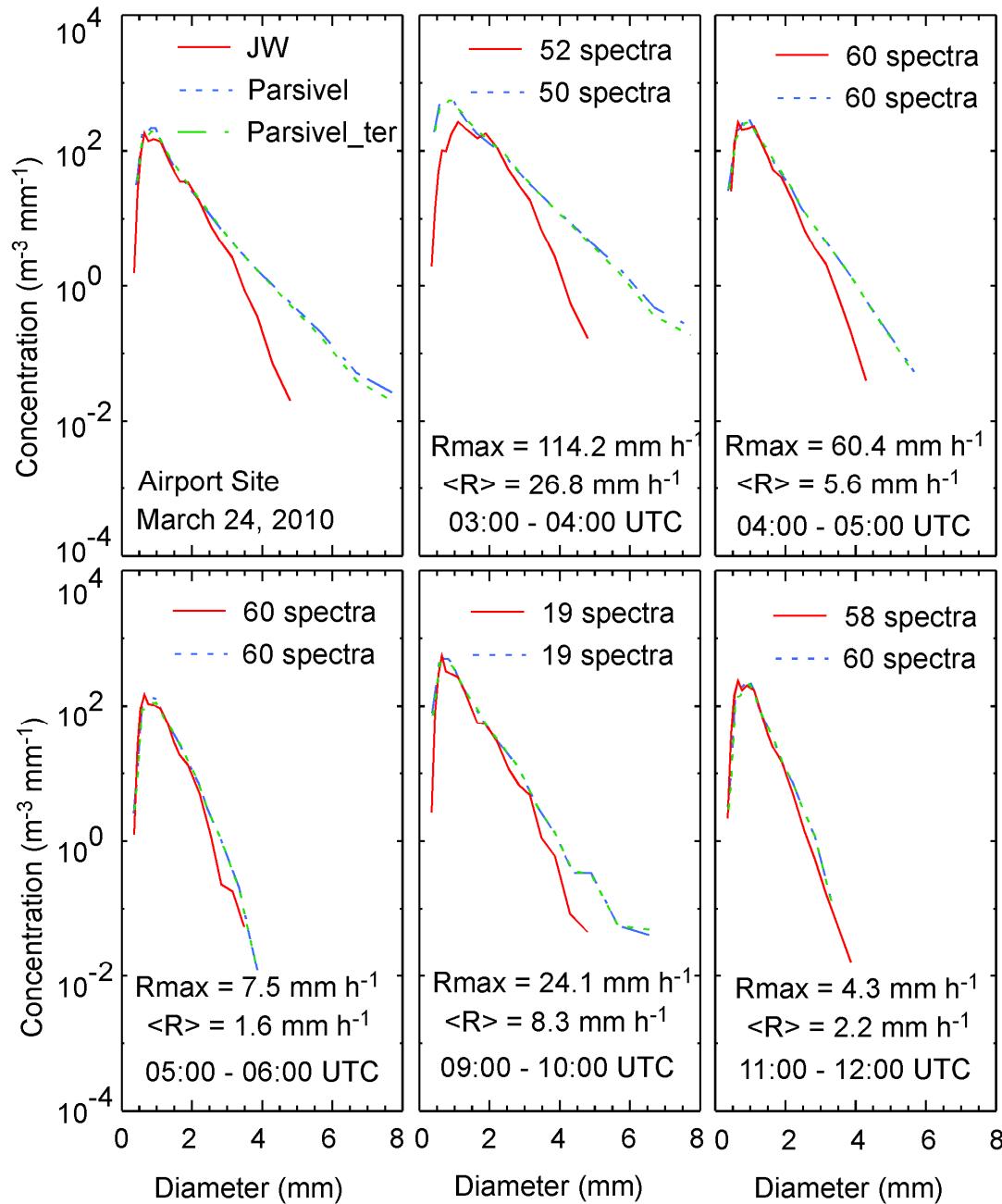
Comparison of Raindrop Size Distribution (event)
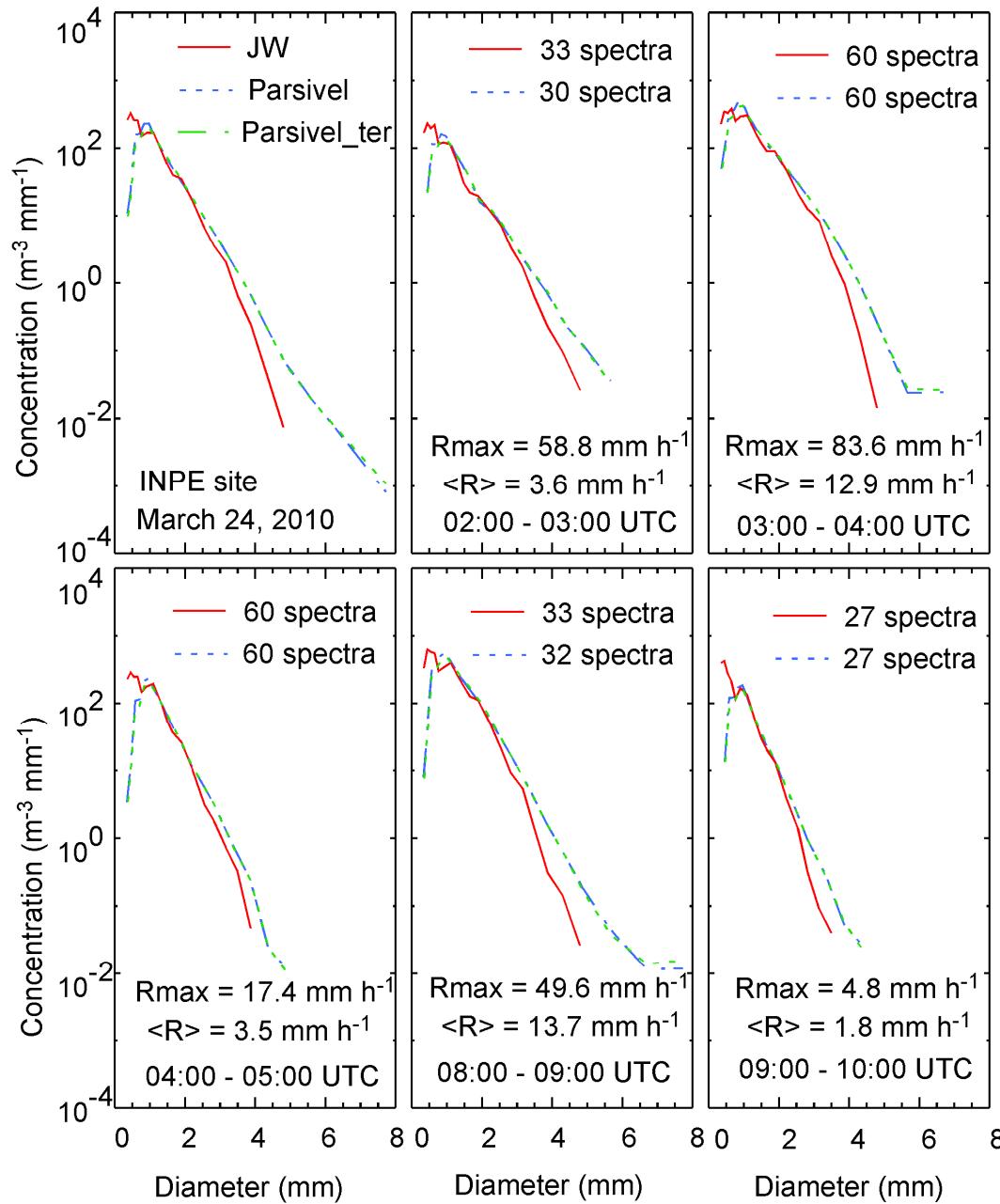
Comparison of Raindrop Size Distribution (instrument)
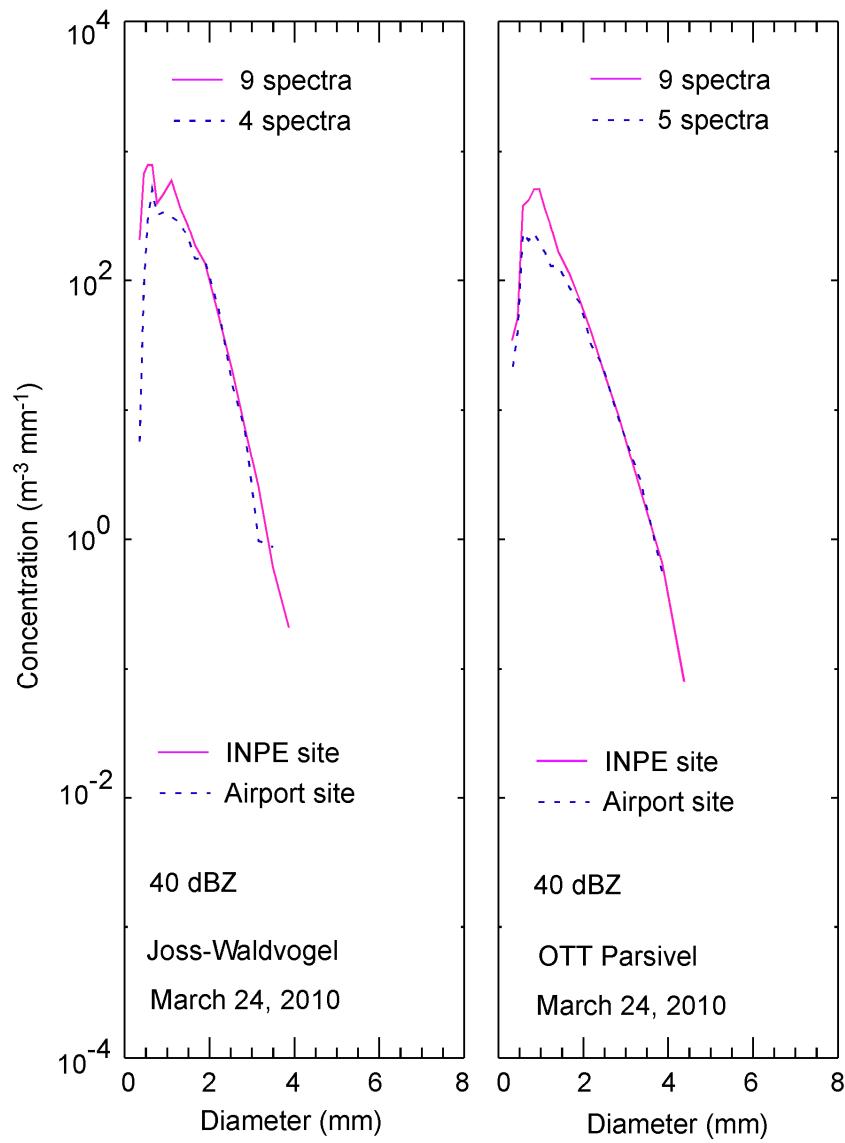
Comparison of Raindrop Size Distribution (microphysics)
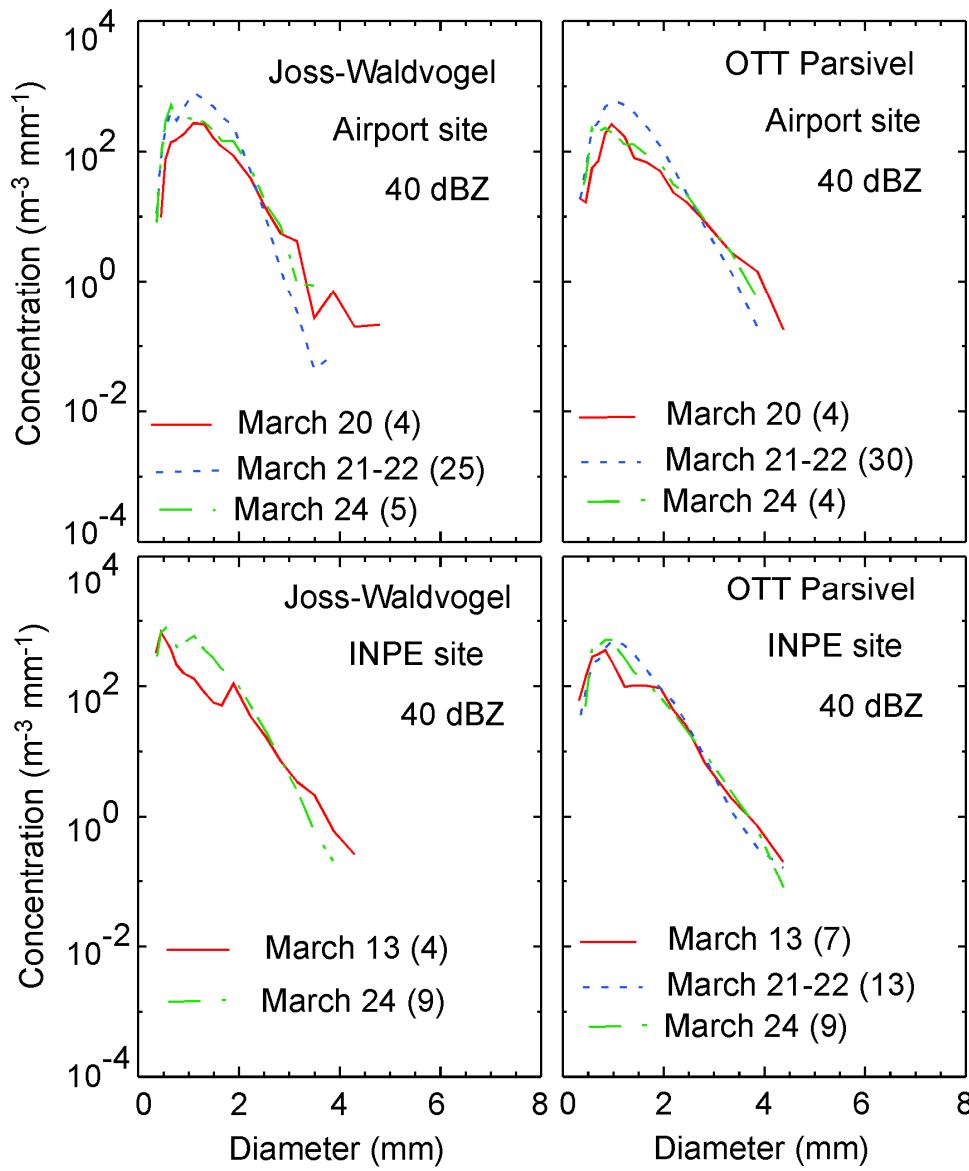
OTT Parsivel Fall Velocity Measurements
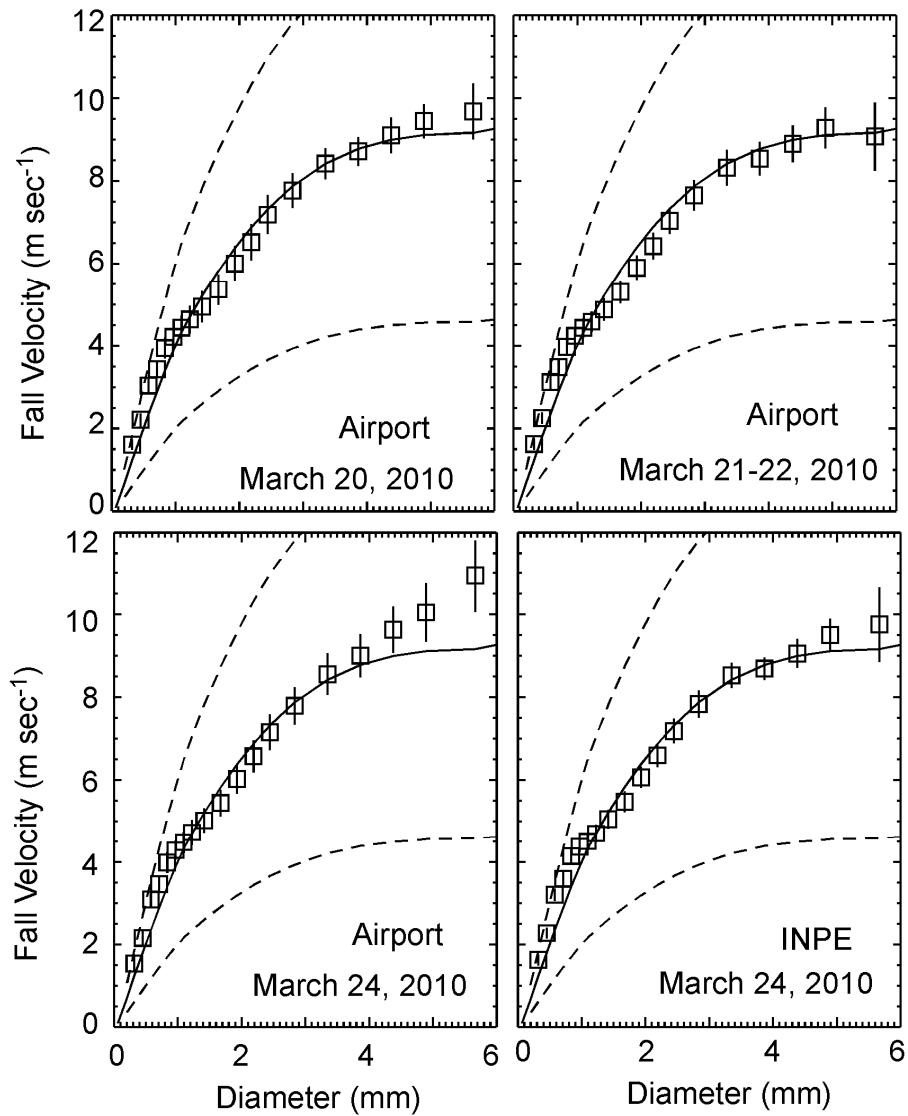
Parameterization of Raindrop Size Distribution

$$N(D) = N_T^* f(m) (\frac{D}{D_{mass}})^m \exp[-(4+m)\frac{D}{D_{mass}}]$$

where
$$f(m) = \frac{(4+m)^{m+1}}{\Gamma(m+1)} \qquad N_T^* = \frac{N_T}{D_{mass}}$$

$$N(D) = N_w g(m) (\frac{D}{D_{mass}})^m \exp[-(4+m)\frac{D}{D_{mass}}]$$

where
$$g(m) = \frac{6(4+m)^{4+m}}{256\Gamma(m+4)} \qquad N_w = \frac{256W}{\pi\rho_w D_{mass}^4}$$

Comparison of Raindrop Size Distribution Parameters

Gamma model parameters	03/20/10	03/21-22/10	03/24/10	03/24/10
Normalized intercept (N_T^*)	113	155	77	134
Normalized intercept (N_w)	1486	2825	1090	1495
Mean mass Diameter (D_{mass})	2.03	1.64	2.01	1.87
Shape parameter (m)	2.4, 1.7	4.2, 2.8	2.7, 2.8	1.8, 2.1

Gamma model parameters	03/20/10	03/21-22/10	03/24/10	03/24/10
Normalized intercept (N_T^*)	106	135	68	82
Normalized intercept (N_w)	989	2151	447	1109
Mean mass Diameter (D_{mass})	2.45	1.83	2.85	2.44
Shape parameter (m)	1.2, 0.4	3.3, 1.6	0.6, -0.6	2.5, 1.9

Comparison of Integral Rain Parameters

Integral rain parameters	03/20/10	03/21-22/10	03/24/10	03/24/10
Concentration (N_T)	231	255	155	250
Liquid Water Content (W)	0.314	0.253	0.219	0.225
Rain Rate (RR)	7.0	5.0	4.9	4.8
Reflectivity (Z)	39	35	37	36

| Integral rain parameters	03/20/10	03/21-22/10	03/24/10	03/24/10
Concentration (N_T)	262	248	196	201
Liquid Water Content (W)	0.438	0.300	0.366	0.483
Rain Rate (RR)	10.6	6.3	9.3	11.9
Reflectivity (Z)	43	37	45	43

Comparison of Raindrop Size Distribution Parameters
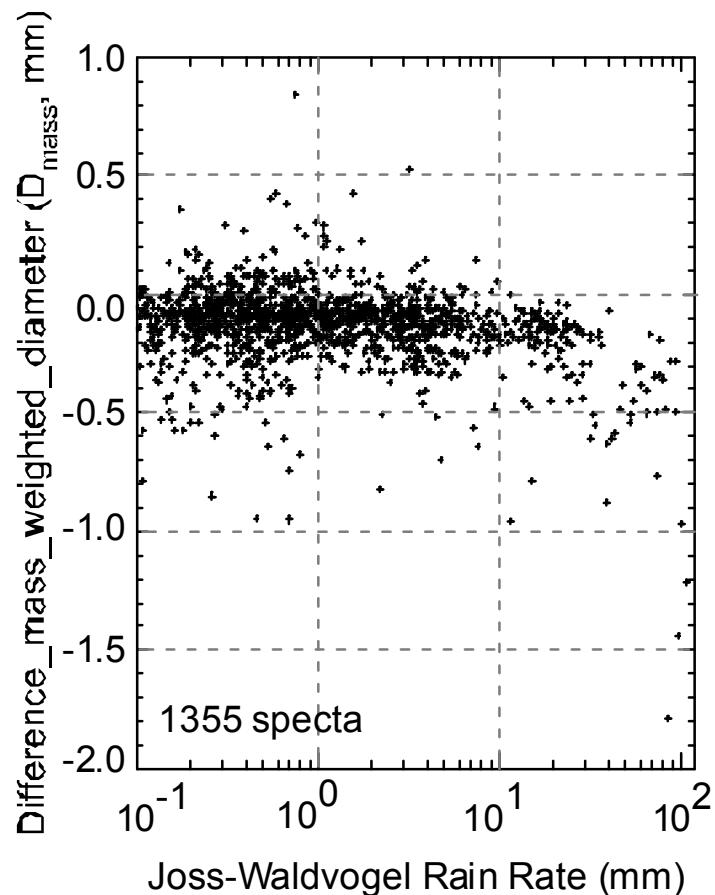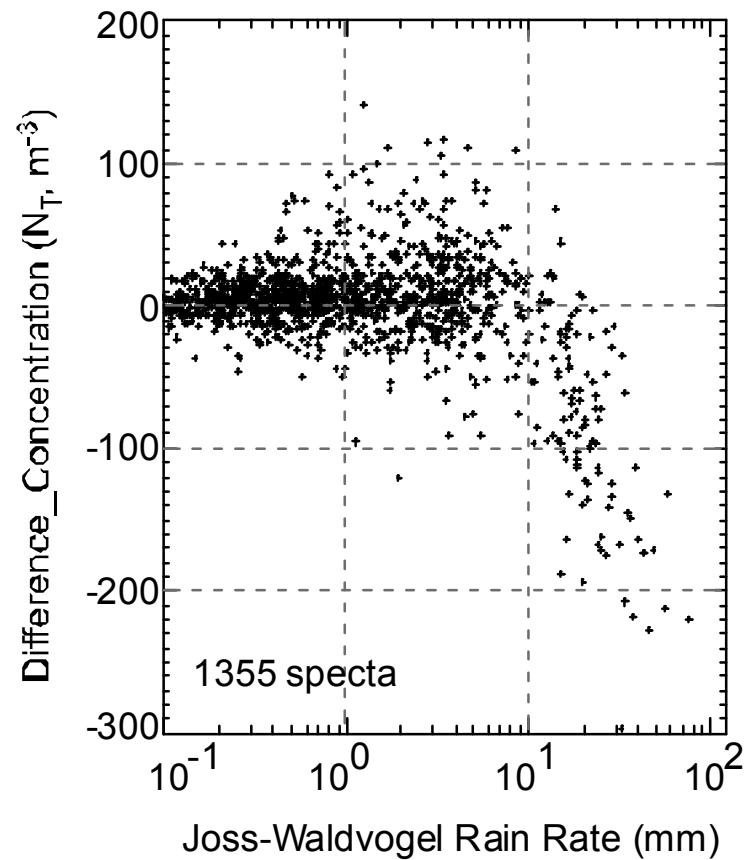
Comparison of Integral Rain Parameters
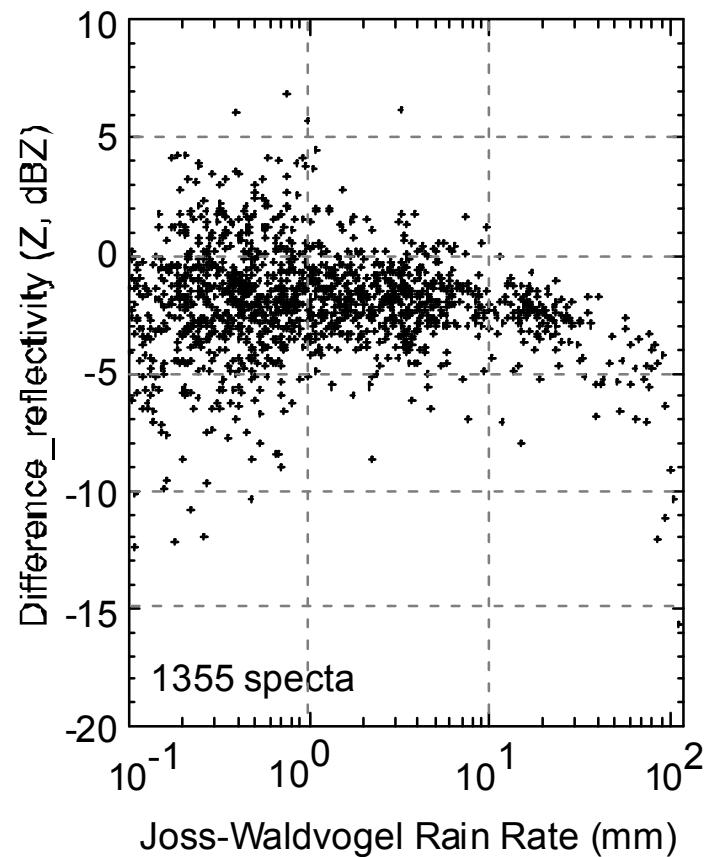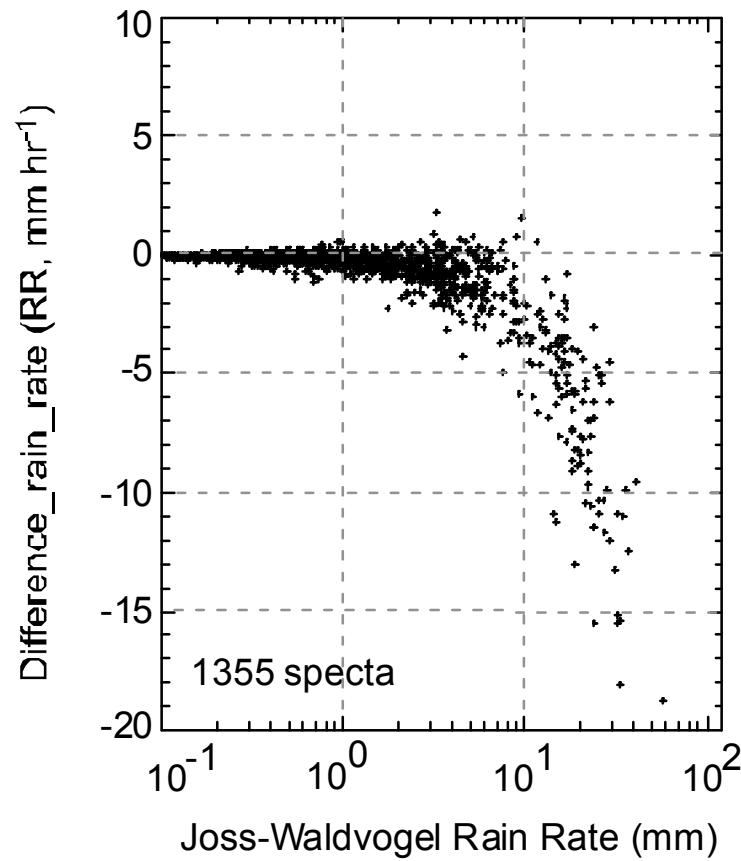
Probability and Cumulative Distributions of Raindrop Size Distribution Parameters
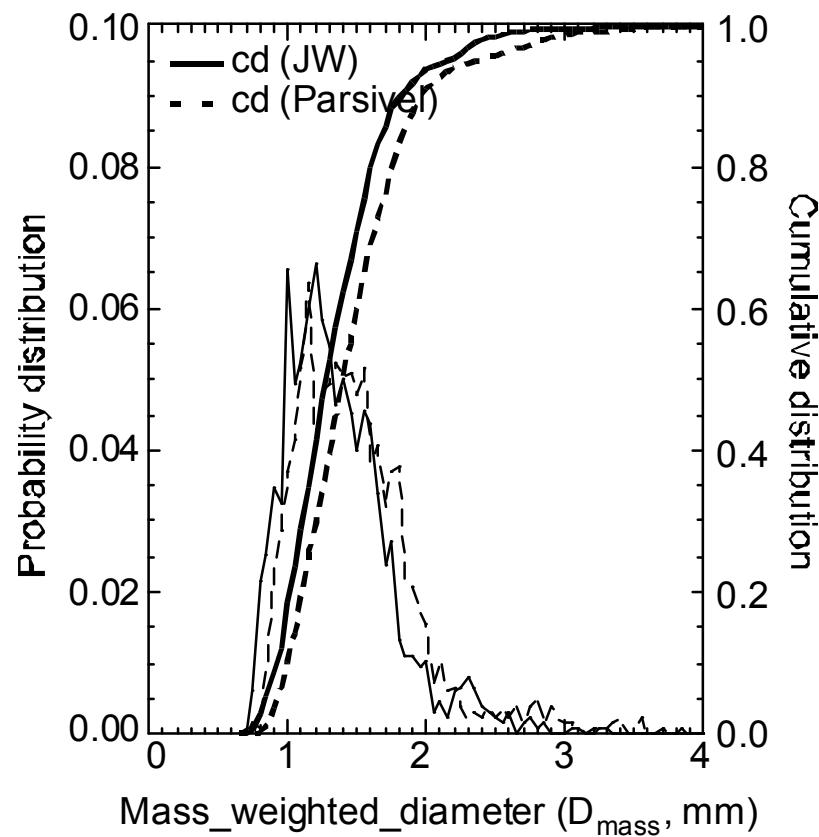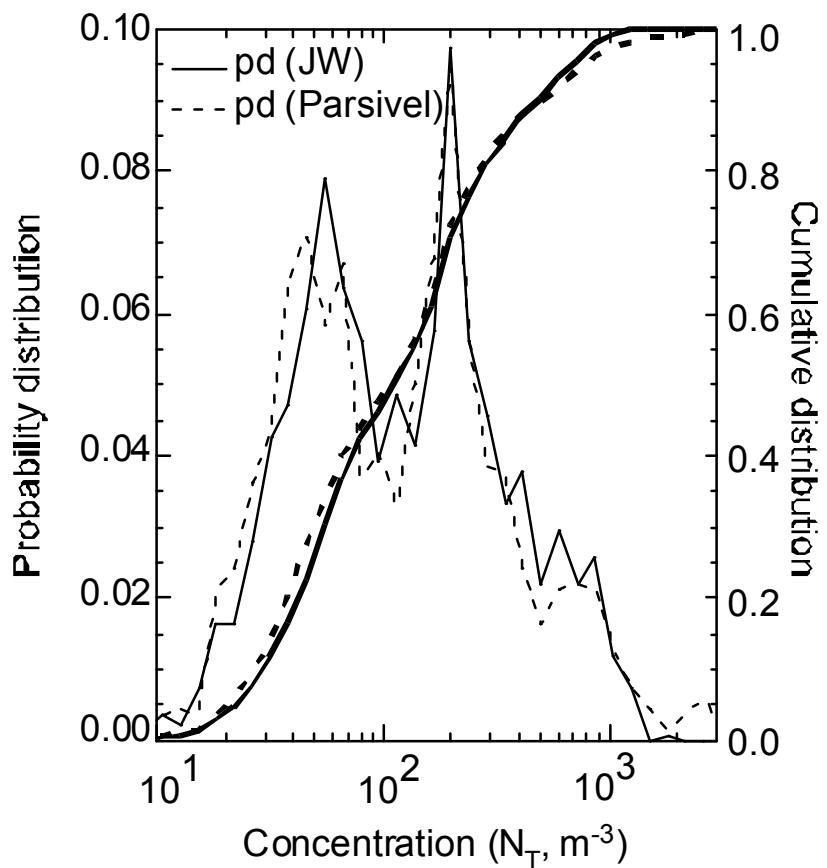
Probability and Cumulative Distributions of Integral Rain Parameters